# Carbonate chemistry dynamics and saturation states of calcium carbonate in the surface waters of the Adriatic Sea.

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The amount of high quality measured carbonate system properties (pH, TA, $TCO_2$, $fCO_2$) is so scarce in the Mediterranean Sea that is almost impossible to have any precise idea of their distribution throughout this semi-enclosed sea (Touratier & Goyet, 2010). The carbon chemistry is even more poorly known in the Adriatic Sea, although this basin is affected by the gradual process of ocean acidification (OA), at least in the northern part (Luchetta A. et al. 2010), receives the runoff of several rivers and hosts sites of dense water formation by two different mechanisms (bottom convection on the shallow shelf in the northern sub-basin and open sea deep convection in the southern sub-basin).

This contribute presents the results of two cruises along the Adriatic Sea, in 2008, that investigated the carbonate chemistry dynamics of surface seawaters ($pH_T$, TA and derived parameters as $TCO_2$, $fCO_2$, $CO_3^{=}$, $HCO_3^{-}$) and the saturation states with respect to aragonite ($\Omega_{Ar}$) and calcite ($\Omega_{Ca}$). The two campaigns were conducted under very different seasonal conditions: characteristic of wintry season in February, as shown by the low sea surface temperature ($8°C<SST<14°C$) and the high quite homogenous density ($29.15<\sigma<29.45$) all along the basin, except on the western slope affected by river runoff, and conditions characteristic of late summer in October, as shown by the warm SST ($17\ °C <SST<21\ °C$) and the higher density stratification ($26.5<\sigma<29.4$) all along the basin.

Surface waters exhibited large spatial and temporal variations in $pH_T$ ($7.945<pH<8.100$) and TA ($2620\ \mu m/Kg_{SW} <TA< 2750\ \mu m/Kg_{SW}$) at 25 °C, as well as large variations at in situ temperature in $fCO_2$ ($230\ \mu atm< fCO_2< 415\ \mu atm$), $TCO_2$ ($2275\ \mu m/Kg_{SW} <TCO_2<2450\ \mu m/Kg_{SW}$), $HCO_3^{-}$ ($2075\ \mu m/Kg_{SW}< HCO_3^{-} < 2250\ \mu m/Kg_{SW}$) and $CO_3^{=}$ ($195\ \mu m/Kg_{SW} < CO_3^{=}<265\ \mu m/Kg_{SW}$), depending on the main drivers (physical pump, biological processes, river runoff).

The average in situ values of $pH_T$, $TCO_2$, $CO_3^{=}$, $\Omega_{Ca}$ and $\Omega_{Ar}$ exhibited by Adriatic surface waters in the two seasons have been compared to those of other oceanic regions (Feely et al. 2009), they show that Adriatic Sea contains the highest amount of dissolved inorganic carbon, thus assessing that Adriatic marine system is able to absorb significant amounts of atmospheric $CO_2$.

In the end, the computed saturation states of calcium carbonate are presented as an interesting example of impacts of OA; actually such parameters have been shown to control the impacts of OA on many marine calcifying organisms. $\Omega_{Ca}$ and $\Omega_{Ar}$ largely vary ($4.75<\Omega_{Ca}<6.45$; $3.1<\Omega_{Ar}<3.9$) in space, within the same cruise, and in time, between the two seasons, in dependence of the major drivers. However their values, being well above the limit ($\Omega=1$)under which calcium carbonate dissolves, indicate a good environmental status for surface waters of the Adriatic Sea.